Citation:

Michaud DS, Augustsson K, Rimm EB, Stampfer MJ, Willet WC, Giovannucci E. A prospective study on intake of animal products and risk of prostate cancer. *Cancer Causes Control.* 2001 Aug; 12 (6): 557-567.

PubMed ID: 11519764

Study Design:

Prospective Cohort Study

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To examine whether specific types of animal products or different components of animal products (e.g., calcium and types of fats) are associated with prostate cancer risk.

Inclusion Criteria:

Participant of the Health Professionals Follow-Up Study, which began in 1986 when male health professionals between 40 and 75 years of age responded to a mailed questionnaire.

Exclusion Criteria:

- Previous diagnosis of cancer (other than nonmelanoma skin cancer) at baseline
- Baseline questionnaire not adequately filled out.

Description of Study Protocol:

Recruitment

Participant of the Health Professionals Follow-Up Study, which began in 1986 when male health professionals between 40 and 75 years of age responded to a mailed questionnaire.

Design

Prospective cohort study.

Dietary Intake/Dietary Assessment Methodology

Self-administered, 131-item, mailed food-frequency questionnaire (FFQ).

Blinding Used

Not applicable.

Intervention

Not applicable.

Statistical Analysis

- Person-time of follow-up was computed for each participant from the return date of the baseline 1986 questionnaire to the date of diagnosis of prostate cancer, death from any cause or January 31, 1996, whichever came first
- Dietary exposures were based on the updated cumulative average of three FFQs (1986, 1990 and 1994)
- Relative risks were computed as the incidence rate among men in each quintile of nutrient or food item intake, divided by the rate among men in the lowest quintile of intake
- Tests for trend were conducted by assigning the median value for each category of intake and modeling this variable as a continuous variable.

Data Collection Summary:

Timing of Measurements

- A baseline questionnaire was administered in 1986
- Biennially starting in 1998, participants completed questionnaires to update exposures and report any disease diagnosis, including prostate cancer, in the previous two years
- In 1986, 1990 and 1994, participants completed FFQs.

Dependent Variables

- Prostate cancer (excluding stage A_1): Self-reported prostate cancer diagnosis with medical record confirmation (in 87% of reported cases)
- Advanced prostate cancer (stages C, D and fatal cases)
- Metastatic prostate cancer (stage D and fatal cases).

Independent Variables

- Intakes of total meat; red meat; dairy products; and combined red meat and dairy products
- Intakes of specific types of meats and dairy products.

Control Variables

- Age
- Ancestry
- Body mass index (BMI)
- Vasectomy
- Exercise
- Smoking history
- Intake of calories
- Calcium
- Lycopene
- Fructose
- Saturated fat

- Alpha-linolenic acid.

Description of Actual Data Sample:

- *Initial N:* 51,529 responded to mailed questionnaire
- *Attrition (final N):* 47,780 after exclusions
- *Age:* 40-75 years at baseline
- *Ethnicity:* Predominantly white
- *Other relevant demographics:* Health professionals
- *Anthropometrics:* None
- *Location:* United States.

Summary of Results:

Key Findings

- Between 1986 and 1996, 1897 total cases of prostate cancer (excluding stage A1) were identified; of these, 536 were advanced and 249 were metastatic cancers
- Intakes of total and red meat were not associated with risk of total or advanced prostate cancer
- An elevated risk of metastatic prostate cancer was observed with intake of red meat, which was slightly attenuated after controlling for saturated fat and alpha-linolenic acid (RR=1.5, 95% CI: 0.88, 2.5; P for trend=0.20)
- Processed meats, bacon and beef, pork or lamb as a main dish each contributed to an elevated risk of metastatic prostate cancer. Men who consumed processed meats twice or more per week had a relative risk (RR) of 1.4 (95% CI: 0.94, 2.1; P for trend=0.08) compared to men who did not eat processed meat, after controlling for saturated fat and alpha-linolenic acid. Similar risks were observed among men consuming bacon twice or more a week (P for trend=0.08). An elevated risk of metastatic prostate cancer was also observed among high consumers of beef, pork or lamb (five or more per week), eaten as a main dish (RR=1.4, 95% CI: 0.72, 2.5; P for trend=0.24)
- Intakes of hamburgers, hot dogs and chicken (with or without skin) were not associated with increased risk of metastatic prostate cancer.

Other Findings

- Those with high intakes of dairy products had an elevated risk of metastatic prostate cancer (age-adjusted RR=1.7, 95% CI: 1.1-2.5), but the association disappeared after controlling for calcium, saturated fat and alpha-linolenic acid
- There was a two-fold increase in the risk of metastatic prostate cancer when those who had high intakes of both red meat and dairy products were compared to those with low intakes of both products, but this association was attenuated after controlling for potential confounders including calcium and fatty acids.

Author Conclusion:

- Dietary intakes of animal products were not associated with total or advanced prostate cancer
- There was a slightly elevated risk of metastatic prostate cancer with frequent consumers of

red meats, but not individual intakes of certain dairy products.

Reviewer Comments:

Study Strengths

- *Measurement error in dietary intake assessment was reduced by using the cumulative average of three FFQs over the study period*
- *Included three outcome measures: Total, advanced and metastatic prostate cancer*
- *Most cancers were verified by medical record review*
- *The food frequency questionnaire was validated in a sub-set of the cohort*
- *Excluded stage A_1 cases, which are usually detected incidentally at surgery and are more prone to detection bias.*

Study Limitations

- *Self-reported cancer diagnoses*
- *Self-administered FFQ.*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

Validity Questions

1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	N/A
2.	**Was the selection of study subjects/patients free from bias?**	Yes

2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	N/A
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	???
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	N/A
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	N/A

5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	???
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	???
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	???
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes

7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	N/A
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes